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METHODS OF EDITING CLOUD AND ATMOSPHERIC LAYER
AFFECTED PIXELS FROM SATELLITE DATA

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16. Abstract Plotted transects made from south Texas daytime HCMM data showed the effect of subvisible cirrus (SCi) clouds in the emissive (IR) band but the effect was unnoticeable in the reflective (VIS) band. The depression of satellite indicated temperatures was greatest in the center of SCi streamers and tapered off at the edges. Pixels of uncontaminated land and water features in the HCMM test area shared identical VIS and IR digital count combinations with other pixels representing similar features. A minimum of 0.015 percent repeats of identical VIS-IR combinations are characteristic of land and water features in a scene of 30 percent cloud cover. This increases to 0.021 percent or more when the scene is clear. Pixels having shared VIS-IR combinations less than these amounts are considered to be cloud contaminated in the cluster screening method. About twenty-percent of SCi was machine indistinguishable from land features in two-dimensional spectral space (VIS vs IR).			
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TYPE II QUARTERLY PROGRESS REPORT

Report Number 4
September 5, 1981 to December 5, 1981

A. Problems:

None

B. Accomplishments:1. Reflective and Emissive Profiles Across Subvisible Cirrus Streamer

Profiles across our south Texas test area on latitude 26.47 N are illustrated in Fig. 1 for the HCMM daytime overpass of 15 Aug. 78. The Gulf of Mexico is on the right side (east). Its low reflectance is apparent in the trace of channel 1 (VIS), and the water temperature of 22 C is represented by the trace of channel 2 (IR). Padre Island, a coastal barrier island, is transected at approximately 97.3 W, showing a high reflectance and warmer temperature. Laguna Madre, between the island and the mainland, appears at 97.4 W. The mainland occupies the remainder of the figure with reflectance generally ranging from 14 to 22 percent, and surface temperatures increasing with distance inland (from right to left). An area of scattered cumulus clouds is shown between 97.6 and 97.9 W.

A subvisible streamer (SCi) present from 98.7 to 99.0 W is undetectable in the channel 1 trace of reflectance in Fig. 1. In contrast the SCi effected a 10 C decrease in satellite-indicated surface temperature in the channel 2 trace. (There was no rain so this was not caused by surface cooling resulting from wetting.) The figure shows that the effect was greatest in the center third of the SCi streamer, where it was most dense, and tapered off to the edges. Similar results were obtained from transects along other latitudes in our test area during the summer season.

2. Limits of Cluster Screening

Previous examination of VIS vs. IR relationships in HCMM data showed that most cloud contaminated data can be screened out by allowing the computer to accept only VIS vs. IR count combinations that recur 0.017 percent or more times in a scene (Wiegand et al.)¹. This method of screening is possible because clouds are individualistic in scatter diagrams of reflective and emissive pixel values, to contrast to noncontaminated land and water features which form clusters caused by shared values. It should be pointed out that the cut off percentage of 0.017 is not a fixed value but varies

¹ Wiegand, C. L., et al. Plant Cover, Soil Temperature, Freeze, Water Stress, and Evapotranspiration Conditions. Type III Final Report prepared for Goddard Space Flight Center. February 1981.

with the amount of cloud cover. (A further consideration is that the cut-off percentage varies with the number of digital counts that represent the full VIS and IR ranges. TIROS-N series satellites have greater digital count ranges, hence their cut-off percentage is smaller than for HCMM.)

In HCMM scenes of our 100,000 pixel south Texas test area, uncontaminated land and water features have shared combinations of VIS and IR counts that occur with at least these frequency:

Percent of scene cloud contaminated	Percent of total scene pixels characteristic of cloud-free features
0	0.0213
5	0.0203
10	0.0192
15	0.0181
20	0.0171
25	0.0160
30	0.0149

The more cloud contaminated a scene is, the lower the incidence of clear pixels sharing the same VIS and IR digital count combination. As clouds increase more contaminated pixels share VIS and IR combinations. This points to the desirability of excluding any large areas of cloud contamination from a scene at the start, before cluster screening is undertaken.

3. Twenty Percent of Subvisible Clouds Indistinguishable in HCMM Spectral Space

Further study of cloud, land and water features represented in spectral space (reflective VIS vs. emissive IR) shows that about twenty percent of thin "subvisible cirrus" (SCI) are machine indistinguishable from land features. The overlap of SCI on land features is apparent in Fig. 2 of our last quarterly report (Number 3).

4. Search for Multispectral Examples of Subvisible Cirrus

An objective of this investigation is to determine whether SCI areas in scenes can be routinely identified for removal from the multiband meteorological satellite data. The discussion above points to the screening difficulty when only the two channels of HCMM are available. Our examination of TIROS-N data has been unfruitful because of the noise in channel 3 (mid IR) of that satellite. We have examined one south Texas NOAA-7 scene (26 Oct. 81) but it was free of SCI so no analysis could be made. These NOAA-7 data are of excellent quality. We are continuing our quest for suitable data.

C. Significant Results:

None

D. Publications:

None

E. Recommendations:

None

F. Funds Expended: (through 30 Nov 1981)

Allotment for FY 81 - - - - -	\$48,088
Location and Indirect Program Costs - - - - -	11,490
Salaries - - - - -	15,349
Travel and transportation - - - - -	0
Transportation of things - - - - -	0
Services and supplies, and equipment - - - - -	<u>10,973</u>
Total	37,812
Balance	10,276

G. Data Utility:

We are using the same HCMM data sets for this study as were used for the initial HCMM contract. The data are of good quality. Examples of subvisible cirrus clouds (SCi) have been found in TIROS-N data. Noise in channel 3 (3.55 to 3.93 um) may prevent using TIROS-N data to develop a multispectral screening method for removing SCi contamination that uses this channel.

15 AUG 78 HCMM LATITUDE 26.47 PROFILE

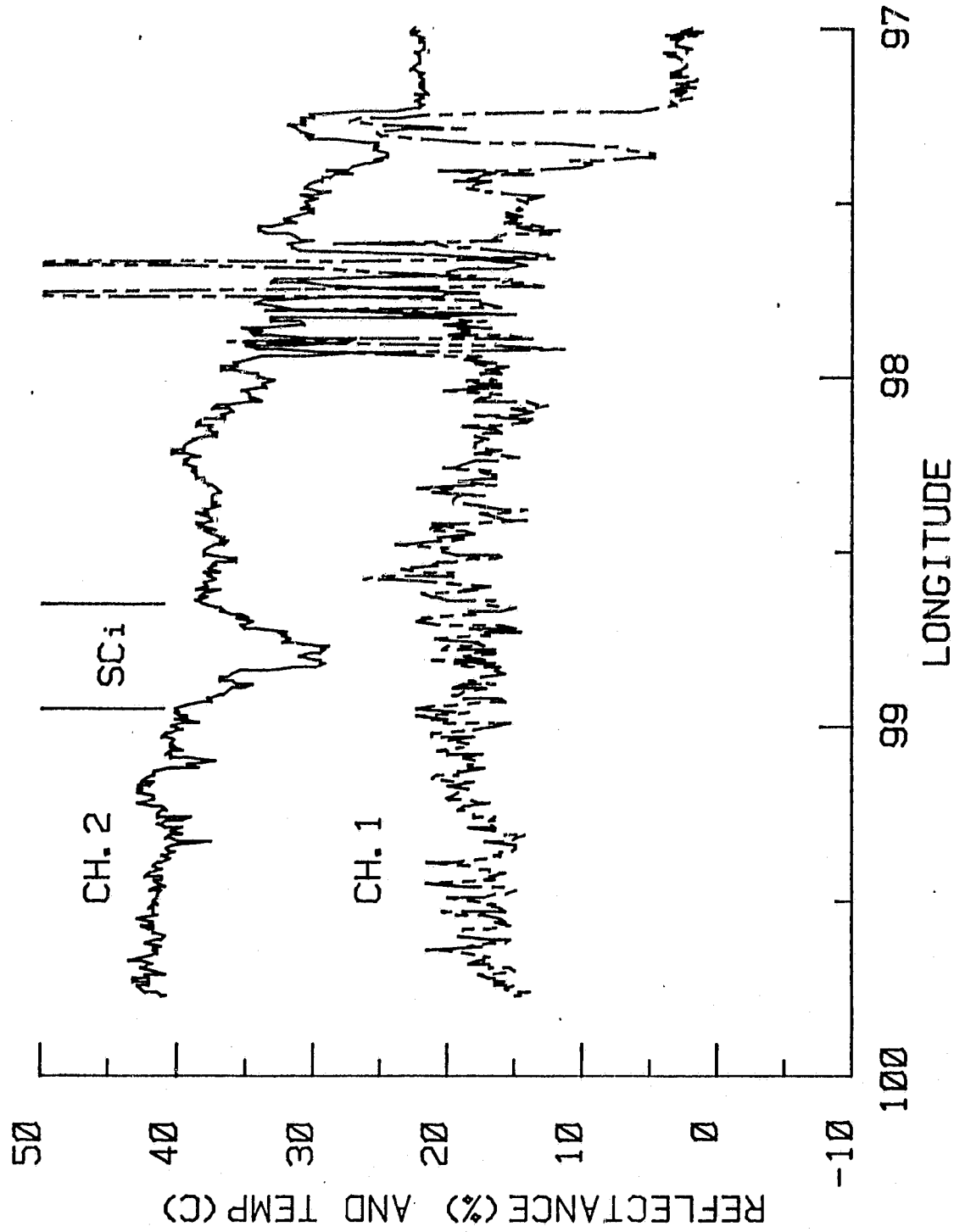


Fig. 1. Reflected (VIS, Ch. 1) and emitted (IR, Ch. 2) radiation across the HCMM south Texas test area on latitude 26.47 N. 15 Aug 78.